

IAF SPACE EXPLORATION SYMPOSIUM (A3)  
Space Exploration Overview (1)

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NASA'S HUMAN LUNAR EXPLORATION ENTERPRISE: DEVELOPING A DEEP SPACE  
INFRASTRUCTURE AND ESTABLISHING A SUSTAINABLE HUMAN PRESENCE ON THE MOON**Abstract**

NASA is leading the effort for humans to walk on the Moon once again—this time as part of an evolving strategy to enable human expansion across the solar system. Hardware and procedures will be developed and tested at the Moon as a precursor to more ambitious missions to Mars. In the half century since Apollo astronauts set their first tentative steps on the Moon, we have gained substantial new knowledge of the lunar environment and resources, preparing us for a sustainable presence on and around Earth's nearest neighbor.

This next wave of lunar exploration will be fundamentally different than the past. The goal today is sustainability – sustainability of presence in Earth orbit, exploration around the Moon, exploration anywhere on the Moon, and challenging exploration missions beyond the Moon. Sustainability is the key to enabling human expansion across the solar system and requires the early engagement of scientific, international, and U.S. commercial interests, innovations, and new approaches.

To do this NASA, along with commercial and international partners are developing the Gateway and the Human Landing Systems (HLS) as initial critical pieces of the lunar architecture that will enable sustainable surface exploration while providing an in-space reusable approach for lunar landing systems. Using a Gateway in cislunar space enables the HLS, consisting of a three-part lunar landing capability with two parts fully reusable and a third part, the descent lander as initially expendable. HLS also encompasses a transfer vehicle to take the lander to and from lower lunar orbits as well initial surface suit development to allow humans to walk on the Moon once more.

This paper will provide an overview of NASA's human lunar exploration portfolio including the status of the Gateway Program and progress toward the launch of the first module – the Power and Propulsion Element – in 2022; Human Landing Systems formulation including an update on the U.S. industry studies

planned for 2019; as well as a summary of the ground testing and other risk reduction activities being performed by NASA teams and industry across the United States. It will also articulate the integrated architecture and concept of operations for the lunar missions in the next decade.